

# Zirconia Based Crowns for Esthetic Rehabilitation of Severely Discolored Teeth: A Case Report

Anissa BM\*, Chakroun M, Hadyaoui D, Nourira Z and Cherif M

*Faculty of dentistry, Street Avicene Monastir, Tunisia*

**\*Corresponding author:** Anissa BM, Faculty of dentistry, Street Avicene Monastir, Tunisia, Tel: +216 52908410, E-mail: benmoussa\_anissa@yahoo.fr

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## Abstract

According to studies, the smile is the first contact in human relationship. With the “media smile” in our society today, esthetic concerns of our patients are increasing. Despite the long-term reliability of the metal-ceramic prostheses, they have some disadvantages (transmission of light is blocked by the metal, corrosion, cervical tattoo. To overcome these shortcomings, the authors focused their research towards fully ceramic restorations in search of a natural mimicry. There are many types and manufacturing procedures of ceramic, the choice of the best ceramic for a case must be guided by several parameters. In this article a 38-year female patient consults for an esthetically compromised smile due to discolored upper anterior teeth and she requests esthetic smile rehabilitation, the presence of defective restorations and recurrent caries excluded treatments modalities such as bleaching and veneers in favor of full ceramic crowns. Incisors, canines and premolars were restored with CAD/CAM zirconia based ceramic crowns.

**Keywords:** Esthetic smile; Ceramic crown; Zirconia; CAD/CAM manufacturing

## Introduction

The rehabilitation of an unaesthetic smile in the anterior maxilla is always a clinical challenge, especially when an improper shape and size, old restorations, and unesthetic shading are present [1]. Decision-making is a fundamental aspect of clinical dentistry. Advances in technology and trends towards more conservative technologies have broadened the options available to patients and dentists, increasing the range of choices and opportunities to restore teeth [2]. With brown intrinsic staining, the discoloration is often more difficult to address, and bleaching procedures alone will likely not be sufficient to achieve the desired result [3]. Porcelain veneers have been shown to be a good conservative and aesthetic treatment option. However they do have limitations, such as important discolorations or extended carious lesions, in similar situations full coverage crowns should be indicated [4]. Coming to the clinical situation which will be presented, full coverage ceramic crowns seem to be the suitable solution meeting the high esthetic demand of the patient.

All-ceramic crowns have been used over the last four decades as an alternative for porcelain-fused-to-metal crowns to overcome their esthetic limitations. All-ceramic crowns can be made from different types of ceramics, which have different physical and esthetic properties [5]. Currently, high translucency zirconia is an option worth considering for restorations that need to be aesthetically superior and serve patient well for years [6]. The accuracy of computer-aided design/ computer-aided manufacturing (CAD/CAM) systems is linked to their technical characteristics and reliability for manufacturing the restoration designed [7]. In addition, different types of tooth preparations influence the marginal precision of zirconium-oxide based ceramic single crowns. In an in vivo study, the marginal fit of zirconium-oxide based ceramic single crowns with vertical and horizontal finish lines were compared, it was concluded that the gaps of the zirconium-oxide-based ceramic CAD/ CAM crowns with vertical and horizontal finish line preparations were not different [8].

## Case Presentation

A 38-year healthy female patient presented for restoring her maxillary teeth at the fixed prostheses department of dental clinic of Monastir. She complained about anterior teeth discoloration and asked for an esthetic smile with arranged and white teeth. Intra-oral examination showed a low smile line, hiding gingival margins as well as cervical decay with significant substance loss. The central incisors and the right lateral incisor have been filled with a composite resin dating since three years. The restorations were visually defective (Figures 1 and 2). Restoration defectiveness has been confirmed by probing during the clinical examination.

Plaque Index was 4, retained by the surface roughness of the decays. When smiling, the patient didn't show the gum line. The anterior guide is functional without interferences.



**Figure 1:** Extra-oral view showing a low smile line not discovering the gingival margin



**Figure 2:** Intra-oral view

The dental substance loss is important as well as occlusal context presented by a deep bite. In addition, teeth were endodontically treated (they are fragile exposed to fracture).

Ceramic crowns were indicated for maxillary incisors, canines and first premolars, since we need to extend the preparation in the sulcus to cover all the discolored abutments, zirconia crowns were indicated.

The preparations were performed using specific diamond burns with appropriate profile for all ceramic restorations: Optimal incisal reduction range from 1.5-2.0 mm, labial and lingual reduction ranges from 1.0-1.5 mm, finish line is a deep chamfer with rounded internal line angles. Chamfer finish line must be prepared with a circumferential step or at an angle of  $>50^\circ$  (horizontal). The total occlusal convergence angle (vertical) can range between  $4^\circ$  to  $6^\circ$  (Figure 3). The margins were extended inside the sulcus to hide abutments discolorations and to give more room for reshaping, contour, and also a better retention [9,10].



**Figure 3:** Teeth Preparations

The optical behavior of zirconia systems evaluated is different from the human dentin. Such difference should be taken into consideration to achieve a highly esthetic restoration with a natural appearance [11].

Temporary prostheses were made in the laboratory using a rigid resin, and sent to the clinic the day of teeth preparation (Figure 4). These temporary prostheses were well polished to save occlusal and esthetic criteria, and bonded for many weeks till validating aesthetic criteria (shape, color, size and position of teeth,...) and functional criteria noted phonation which should not be disturbed. In addition, it must not interfere during the functional mandibular movements. That's why visits were phased out weekly, and in each appointment, they were checked, and rectified by subtraction or resin addition, the temporary crowns were polished before bonded again. As this temporary prosthesis was well accepted by the patient and his entourage, it served as the final project prototype. The next step was making the working impression after two weeks of provisional crowns validation.

Impression was taken using polyvinyl siloxane also known as addition silicone which has been popularized recently. Based on literature review, this material has demonstrated superior physical properties and has attained clinical success. It possesses minimal permanent deformation values, excellent dimensional stability and produces accurate stone dies when compared to other impression materials. They have very low polymerization shrinkage and produces no by-products [12,13].

Prostheses were fabricated using indirect CAD/CAM technique, the impression was performed, then sent to the laboratory. There, the working cast was scanned and infrastructures were manufactured by computer aided manufacturing.



Figure 4: Temporary Prosthesis

Zirconia infrastructure was tried (insertion, margin fit, retention...). Then, space left to the feldspathic ceramic was verified rectification was done using a diamond chamfer with irrigation not to heat the zirconia (Figure 5). Then, the infrastructures were sent to the laboratory for ceramic stratification.



Figure 5: Trying Infrastructures

In the clinic, after ceramic stratification, esthetic and occlusion relationship were checked, and crowns were glazed and seated using adhesive sealing cement (Figure 6).



Figure 6: Extra-oral view after adhesive cementation

Due care was given to the removal of cement excess. The patient was recalled after one month for control then recalled after six months, no problem was revealed in the control visits.

## Discussion

Extensive and cervical tooth decay as well as defective and significant resin restorations, exclude the indication of veneers in favor of all ceramic crowns. In case of severe discoloration and subgingival margins, zirconia crowns are a suitable alternative. However, despite the gingival display the patient refused any surgical procedure.

Zirconia-based tooth-supported crowns showed promising clinical results restoring anterior teeth [14-17]. CAD/CAM technology in the manufacture of Zirconia has become a reality in dental practice that demonstrates important physical and mechanical properties of high strength, adequate fracture toughness, biocompatibility and esthetics outcome [18,19].

An in vitro study shows that the accuracy of margin fit was dependent on the scanning system. The direct digitalization was not superior to indirect digitalization for all tested systems [20]. But another study concluded that with both methods, the shorter the distance, the more accurate results were achieved. Virtual models obtained by digital impressions can be more accurate than their conventional counterparts [21]. Whatever the technique used, to optimize the result and the longevity, the proper support given to the veneering ceramic by the correct design of the zirconia framework could significantly reduce the risk of chipping during function [22]. In addition, marginal adaptation is essential for the long-term success of dental restorations, the more accurately the restoration is adapted to the tooth the lesser the chance of recurrent caries or periodontal disease [23,24].

In case of subgingival margin, it is difficult to manage bonding procedure where it is necessary to choose a resin based cementation. For cementation, glass-ionomer cements are versatile acid-base materials with a variety of uses in modern dentistry. They show a degree of bioactivity when set that causes them to develop an interfacial ion-exchange layer with the tooth, and this is responsible

for the high durability of their adhesion to the tooth surface [25]. Resin-modified glass-ionomer (RMGI)-based luting agents have been recently marketed to improve prosthesis retention. A study investigated the influence of conventional cementation, self-adhesive cementation, and adhesive bonding on the in vitro performance, fracture resistance, and marginal adaptation of zirconia-reinforced lithium silicate (ZLS) crowns, it seems that marginal adaptation and fracture forces of all tested groups are in a range, where no restrictions should be expected for clinical application [26].

## Conclusion

Esthetic demand of patients is widely increasing mainly in case of esthetically compromised anterior maxillary teeth by the presence of defective restorations. Full coverage zirconia crowns are currently a suitable solution in case of discolorations and subgingival tooth decay. This solution can offer an esthetic result since the infrastructure zirconia is marketed with different translucidities' and cosmetic ceramic can be retouched by ceramic makeup. In addition, ceramic zirconium offer good mechanical properties and a good long term behavior, it's also a solution for anterior teeth when bonding cannot be indicated.

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